

VOLTAGE STABILISER FOR ELECTRICAL ENERGY
TRANSPORTATION AND DISTRIBUTION APPLICATIONS

SPECIFICATION**OBJECT OF THE INVENTION**

The herein descriptive specification refers to an Invention Patent application, in relation to a voltage
5 stabiliser for electrical energy transportation and distribution applications, the aim of which is to enable its use as a voltage stabiliser at different electrical energy voltage levels, capable of being installed in single phase and three phase networks,
10 consisting of one or several electromagnetic devices of transformer type and which, in incremental steps, regulates the output voltage which reaches the consumers.

FIELD OF THE INVENTION

15 This invention is for application within the industry dedicated to the distribution of electrical energy, to be precise within electrical networks with large voltage drops.

BACKGROUND OF THE INVENTION

20 Problems with the regulation of voltage in electrical energy distribution networks are customary, as is the implantation of equipment with the aim of mitigating the problem.

Worth mentioning is the embodiment as auto-
25 transformers with intake points, controlled by static or mechanical switches, as well as the use of motorised, continuously regulated auto-transformers.

This equipment performs the function required of them, but at the price of a large economic investment
30 and/or a considerable reduction in supply reliability.

For its part the applicant is unaware of the current existence of any voltage stabiliser for electrical energy transportation and distribution applications that is designed to be implanted in
35 electrical networks with large voltage drops and which

presents the same features as the one described in this specification.

DESCRIPTION OF THE INVENTION

5 The voltage stabiliser for electrical energy transportation and distribution applications proposed by the invention constitutes in itself an evident innovation within its field of application.

10 To be more precise, the voltage stabiliser for electrical energy transportation and distribution applications takes the form of a voltage stabiliser for electrical energy transportation and distribution applications, admitting of installation in single phase and three phase networks, consisting of one or several electromagnetic devices of transformer type and which, 15 in incremental steps, regulates the output voltage which reaches the consumers.

20 The basic regulation device consists of a transformer with a primary dual or quadruple winding, and with a simple secondary winding, prepared to withstand the line's full intensity.

The simple winding may be positioned before or after the parallel branch, the performance of the equipment remaining the same.

25 With the aid of the appropriate commutation of the primary windings, corrections are made to the output voltage, with the purpose of keeping it within pre-set margins.

30 This basic element offers features of very considerable economy, robustness and efficacy, the output discretisation being five or nine-step, which makes the invention of interest to installations where there is a major problem of voltage regulation and where a coarse regulation is required at around the nominal voltage value.

35 Nevertheless, should greater resolution be needed,

the invention admits the use of devices in series, with regulations stepped 4:1.

DESCRIPTION OF THE DRAWINGS

In order to complement the herein description, and
5 with the aim of assisting in the better understanding
of the invention's characteristics, attached to the
herein specification, and forming an integral part of
it, is a set of plans in which, by way of illustration
and in no way limiting, the following has been
10 depicted:

Figure 1.- offers a graphic representation of the
single phase scheme equivalent of the equipment's power
circuit and shows, to be more precise, the downstream
compensation which allows the main transformer's power
15 to be reduced, at the price of not exploiting to the
full the magnetic circuit at non-nominal voltages.
Figure 1 corresponds to the object of the invention
relating to a voltage stabiliser for electrical energy
transportation and distribution applications.

20 Figure 2.- offers a view similar to that shown in
figure 1, exploiting to the full the magnetic circuit
at non-nominal voltages as a consequence of upstream
compensation.

PREFERRED EMBODIMENT OF THE INVENTION

25 The voltage stabiliser for electrical energy
transportation and distribution applications which is
being proposed and which is specifically designed for
electrical energy transportation and distribution
applications, may be embodied for a single phase or
30 three phase network. The elements specified are those
used in the single phase equipment, but it should be
pointed out that the construction of the three phase
stabiliser is immediate given that all that is needed
is to triplicate the equipment if one control per phase
35 is desired, or to triplicate the number of contactor

and relay poles, should a joint control be desired.

As may be seen in figures 1 and 2, there are two variants of the single phase scheme equivalent of the equipment's power circuit, the difference as shown
 5 between both residing in the fact of whether the line compensation is before or after the parallel branch.

The downstream compensation, shown in figure 1, allows the main transformer's power to be reduced, at the price of not exploiting to the full the magnetic
 10 circuit at non-nominal voltages. There is full exploitation in upstream compensation, the scheme for which is shown in figure 2.

The voltage stabiliser for electrical energy transportation and distribution applications is
 15 composed of a transformer, trip/contactors/relay elements and a control panel.

The transformer takes the shape of a transformer whose primary voltage is the same as the line's nominal single phase voltage (V_{fn}), as referred to in the
 20 figures mentioned above, and whose secondary voltage is the same as the maximum voltage increase that it is wished to inject into the line (V_{iny}), also to be seen in the figures.

The primary winding is coiled double in two
 25 electromagnetically identical coils. This enables it to be connected at the $2 \cdot V_{fn} / V_{iny}$ connection too.

In the case of downstream compensation, as shown in figure 1, the power of this machine will be $V_{iny} \cdot I_{linea}$, where I_{linea} is the nominal current of the
 30 line on the stabilised side. In the case of upstream compensation, the scheme for which is shown in figure 2, the power of this machine will be $V_{iny} \cdot I_{linea} (1 + V_{iny} / V_{fn})$, albeit the services of compensation provided are higher.

35 With respect to the trip/contactors/relay elements,

it should be pointed out that the equipment requires a power-cutting element (C1) with one normally closed contact (NC) and another normally open (NO), at a nominal line current.

5 In addition two isolator elements (R1 and R2) are needed, each of which is provided with two normally open contacts and two normally closed contacts (NO and NC respectively), with a nominal V_{fn}/V_{iny} , the current of the line. These two elements may be substituted by
10 static cutting elements.

As for the control panel, it should be pointed out that it consists of a microprocessor which measure the output voltage and sends the orders to the trip, contactor and relay elements, in order that they are
15 correctly configured for adjusting the voltage within limits.

As for the mode of operation, it should be pointed out that the configuration of the contactors as shown in figure 1 allows for five possible manoeuvres to be
20 carried out. Namely:

- With C1, that is to say the power cutting elements, at rest and the isolator elements in any position, the equipment is physically disconnected from the network. It should be pointed out that this mode
25 of operation allows the continuity of the supply to be guaranteed in the face of a failure in the equipment, as well as avoiding the introduction of losses in the non-stabilisation situation.

- With C1 activated and the two isolator elements
30 at rest, the regulator multiplies the input voltage by $(1+0.5 \cdot V_{fn}/V_{iny})$. In nominal conditions this means an injection of $+0.5 \cdot V_{fn}/V$.

- With C1 and R1 activated and R2 at rest, the regulator injects into the network a voltage of $+V_{iny}$ V
35 in nominal conditions.

- With C1 and R2 activated and R1 at rest, the regulator injects into the network a voltage of $-0.5 V_{iny}$ V in nominal conditions.

5 - With C1, R1 and R2 activated, the regulator injects into the network a voltage of $-V_{iny}$ V in nominal conditions.

That is to say, C1, to be precise the power cutting element, connects the equipment, while one isolator element (R1) determines the magnitude of the
10 trip ($0.5 \cdot V_{iny}$ or V_{iny}) and the other isolator element (R2) determines the configuration's polarity (+/-).

The control of the basic element measures in network cycle real time the effective values of the equipment's output voltages, thus permitting them to be
15 stabilised within a margin of $[V_{fn} \pm V_{iny} / 4]$, provided that the input voltage lies within the interval $[V_{fn} \pm V_{iny} / 4]$.

The voltage compensation manoeuvres are carried out in line with the following process, namely:

20 1.- Deactivation of C1.

2.- With the aid of C1's auxiliary contact, verification that the manoeuvre was carried out correctly.

3.- Activation/deactivation of R1 and R2
25 (manoeuvre without voltage or current).

4.- Activation of C1.